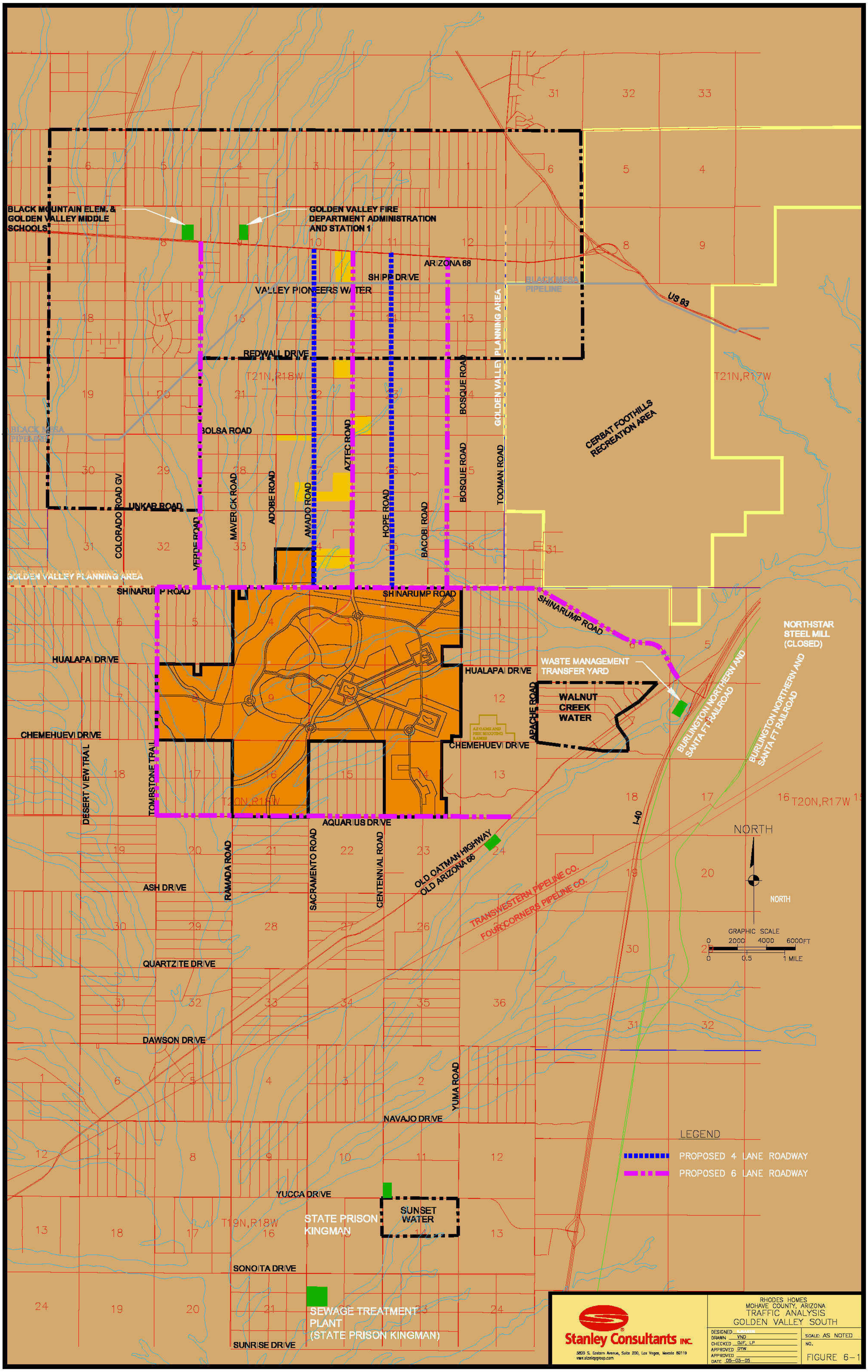
BLACK MOUNTAIN ELEM. & GOLDEN VALLEY MIDDLE SCHOOLS
GOLDEN VALLEY FIRE DEPARTMENT ADMINISTRATION AND STATION 1
ARIZONA 68
SHIPP DRIVE
VALLEY PIONEERS WATER
BLACK MESA PIPELINE
US 93
REDWALL DRIVE
T21N,R18W
T21N,R17W
BOLSA ROAD
AZTEC ROAD
BOSQUE ROAD
GOLDEN VALLEY PLANNING AREA
CERBAT FOOTHILLS RECREATION AREA
TOOMAN ROAD
UNKAR ROAD
COLORADO ROAD GV
MAVERICK ROAD
ADOBE ROAD
AMADO ROAD
HOPE ROAD
BACOBI ROAD
VERDE ROAD
SHINARUMP ROAD
NORTHSTAR STEEL MILL (CLOSED)
WASTE MANAGEMENT TRANSFER YARD
HUALAPAI DRIVE
APACHE ROAD
WALNUT CREEK WATER
BURLINGTON NORTHERN AND SANTA FE RAILROAD
CHEMEHUEVI DRIVE
DESERT VIEW TRAIL
TOMBSTONE TRAIL
T20N,R18W
T20N,R17W
AQUARIUS DRIVE
I-40
NORTH
OLD OATMAN HIGHWAY
OLD ARIZONA 66
ASH DRIVE
RAMADA ROAD
SACRAMENTO ROAD
CENTENNIAL ROAD
TRANSWESTERN PIPELINE CO.
FOUR CORNERS PIPELINE CO.
GRAPHIC SCALE
0 2000 4000 6000FT
0 0.5 1 MILE
QUARTZITE DRIVE
DAWSON DRIVE
YUMA ROAD
NAVAJO DRIVE
LEGEND
PROPOSED 4 LANE ROADWAY
PROPOSED 6 LANE ROADWAY
YUCCA DRIVE
STATE PRISON KINGMAN
SUNSET WATER
T19N,R18W
SONOITA DRIVE
SEWAGE TREATMENT PLANT (STATE PRISON KINGMAN)
SUNRISE DRIVE
Stanley Consultants INC.
5820 S. Eastern Avenue, Suite 200, Las Vegas, Nevada 89119
www.stanleygroup.com
RHODES HOMES
MOHAVE COUNTY, ARIZONA
TRAFFIC ANALYSIS
GOLDEN VALLEY SOUTH
DESIGNED
DRAWN VND
CHECKED DJF, LP
APPROVED DYW
APPROVED
DATE 05-05-05
SCALE: AS NOTED
NO.
FIGURE 6-1

Section 7

Wastewater Infrastructure

INTRODUCTION

Wastewater infrastructure for the Golden Valley South property is discussed herein. The section is organized as follows:

1. Sewer System Infrastructure
    a. Project background
    b. Sewer system assumptions
    c. Sewage demand and sewage collection
    d. Sewage treatment
        i. Build a WWTP to treat wastewater from the development
        ii. Use of septic systems
        iii. Incorporation of City of Kingman Downtown Plant flows into the WWTP.
    e. WWTP approval process
        i. Mohave County Planning and Zoning Department
        ii. Arizona Department of Environmental Quality
        iii. Mohave County Environmental Health Department
    f. Comparison of various types of treatment plants
        i. Discussion of available treatment processes
        ii. Common components of a wastewater treatment system
        iii. Biological and filtration components of a wastewater treatment system
    g. Sewage disposal (direct discharge vs. reuse)
    h. Ownership of the sewage system
        i. City of Kingman ownership
        ii. Private company ownership
        iii. Developer incorporates own sewage company
        iv. Developer enters into separate agreements for treatment and collection systems
    i. Use of package plants
2. Water and Wastewater Infrastructure system costs

SEWER SYSTEM INFRASTRUCTURE

Project Background.

Golden Valley South is being developed as a stand alone, "from scratch" system as concerns sewer system development. There is currently no sewage collection system within the project limits. In addition, the entire property is outside of the Kingman city limits and the Kingman 2020 plan area.

Rhodes Homes has indicated that this development will be a "destination location" type of development. As such, Stanley has prepared this report with an understanding that the collection and treatment system will reflect this level of performance and aesthetic.

Sewer System Assumptions.

The following assumptions have been made to determine sewer system demands, treatment alternatives, and disposal alternatives:

1. There is not a development "phasing" plan at this time. Development timing for WWTP expansion is being planned around a development-wide system demand, (see Table 7-1).
2. Average wastewater generation rate = 80 gpcd.
3. Average number of people per household – active adult = 1.9, single family residential = 3.0, multi-family residential = 2.0.
4. Average number of dwelling units per acre = 6 for all developable acres.
5. Sewage flow peaking factors are 1.2 for maximum month, 2.0 for maximum day and 3.0 for peak hour flow (Arizona American Water development standard).
6. Septic systems will not be used for the development.
7. Use of package plants allowed only to 1.5 mgd of capacity, with decommissioning or integration of package plant into permanent plant for capacities greater than 1.5 mgd.
8. Treatment alternatives must be able to produce reuse-quality (A+) effluent for all phases (golf course will be in use at project housing startup).

These assumptions are based on Stanley's understanding that the developer is creating a "destination development" that goes beyond the minimum standards for sewage works currently in place in Mohave County and at ADEQ. As such, widespread use of septic systems and small capacity "package" wastewater plants are not expected to be a part of the development. In addition, a temporary wastewater treatment plant is proposed by Rhodes Homes, which could provide seed flow and alleviate some startup issues.

Sewage Demand and Sewage Collection.

Sewage Demand. As there is no specific development plan for Golden Valley South, a conservative demand approach has been taken. The assumption has been made that all Golden Valley South parcels are being developed with an average of 6 single family residential dwelling units per acre and that each dwelling unit generates an average wastewater flow of 240 gallons per day. Table 7-2, "Golden Valley South Sewage Demands", shows the quantity of sewage generated on a section by section basis for an average day (approximately 8.0 mgd) and shows the peak flow from each section, assuming a peaking factor of 3.0.

Sewage Collection. The backbone sewage collection system is shown in Figure 7-1. The collection system assumes gravity flow from all project areas to the southern end of the development (Section 16) is attainable for the whole Golden Valley South property with the exception of portions of Section 8, where a low-head lift station may be required to move flows to the gravity system. It is assumed gravity flow will be achieved in Sections 11 and 14 by construction of a sewer west of Section 14 in Aquarius Drive. In addition, sewage from approximately 500 acres of Rhodes properties located north of the Golden Valley South property could be added in the future. These parcels, if included, could be tied to the collection system via a sewer line routed down Aztec and Amado Roads and entering Golden Valley South at Amado Road.

To determine the pipe size for each pipe section, the demands for each section were calculated and, using an assumed 1.0% pipe slope and full pipe flow at peak hour flow, the pipes were sized. Flow is additive from section to section, moving west and south and following the flow arrows. Minimum sewer collection main size is 8". Trunk sewer line sizes range from 10 inches to 24 inches at the WWTP (up to 30" if the service area is extended north of Shinarump Road). See Table 7-3, "Golden Valley South Sewer Collection System", for a breakdown of the projected collection system by pipe reach.

It is here noted that these design assumptions expect to be modified as the development plan begins to take shape. These numbers are intended as "ballpark" planning numbers only.

Sewage Treatment

Having assumed that the development will utilize class A+ reclaimed water, the sewage treatment alternatives are limited to that which can produce this type of effluent. The general process units include solids screening and removal, biological treatment for removal of nutrients, clarification, filtration, disinfection, and solids handling. These processes can be achieved by both "package" plants (on a temporary basis) or "permanent" plants, so combinations of treatment alternatives can be utilized to minimize problems with low startup flows prior to the need for a permanent plant and to optimize the cash flow for wastewater infrastructure.

The location of a sewage treatment plant is generally the lowest geographic point in the service area. This typically minimizes collection system costs. The Golden Valley South property is ideally suited for use of the natural topography, as it generally slopes from northeast to southwest at a gradient that allows for gravity flow through almost 100% of the property (approximate gradient slope of 1.0%).

For the Golden Valley South project, the sewage treatment alternatives available to the owner are limited. As there are no existing WWTPs in the vicinity, building a WWTP to treat sewage from the development or the use of septic systems are the only feasible alternatives.

Build a WWTP to treat wastewater from the development. The developer will be required to build a WWTP to treat the development's wastewater at some point in time. Locating the plant at the lowest geographic point in the development, would best serve the development. A reclaimed water pump station would be required to deliver reclaimed water to the development. This station would have a phased design to accommodate reclaimed water demands on an "as-needed" basis.

The WWTP plant phasing would be implemented based entirely on absorption rates of the Golden Valley South property. For purposes of this report, startup plant size is assumed to be 0.5 mgd. The first phase of construction would be most costly on a dollars per gallon basis, as all ancillary and support facilities, as well as much of the buried influent piping and lift station, must be constructed with long-term use in mind. Using the 8.0 mgd capacity figure, a plant site would vary from 6-13 acres in size (excluding effluent recharge fields and sludge storage/disposal areas) which could add significant land area to the plans, dependent on type of technology used to treat wastewater.

Use of Septic Systems. Mohave County administers the residential septic system installation program within the Golden Valley South property. At this time, while there are property line and proximity to well setbacks for septic tanks, there are no restrictions that would preclude use of septic systems in large scale developments. However, recent conversations with Mohave County staff indicate that they are discouraging septic systems for developments greater than 10 homes.

In Stanley's professional opinion, wide scale use of septic systems would not be in the developer's best interests for several reasons:

1. Reuse credits cannot be obtained.
2. Public perception would be negative to an average 6 homes per acre "Destination development" that uses septic tanks.
3. Groundwater resources would require maximum use, as groundwater would be required to water amenities such as golf courses, parks, etc.
4. Use of septic systems on a large scale would eventually degrade the water quality of the aquifer, especially in terms of nitrate escalation. As the Kingman consumer confidence report data suggests, nitrates leaching from septic systems is already a cause of increased nitrate concentrations in the City's well system.

Incorporation of City of Kingman Downtown Plant flows into the WWTP. The City of Kingman is currently experiencing operational challenges with its Downtown WWTP. This could be perceived as an opportunity for Rhodes Homes to enhance their relationship with the City while at the same time gaining certain benefits to the development's wastewater/reclaimed water system. If the flows from the Downtown WWTP could be diverted to the WWTP built for Golden Valley South, the following benefits could result:

1. The City is relieved from operating a facility that is currently a burden and would be quite expensive to upgrade.
2. The Golden Valley WWTP receives a base flow that will improve plant performance from the first day of operation (plant performance is often questionable at startup of the facility due to low flow being unable to keep a constant food source for biological colonies that provide nutrient removal).
3. An additional revenue source is on-line from the first day of operation.

A large part of making this option feasible is the willingness of the City of Kingman to construct and pay for the transmission system from the Downtown WWTP to the Golden Valley WWTP. It is assumed that a lift station and approximately 10 -11 miles of transmission main are required. This would be a sizeable investment (on the order of $3,000,000 to $4,000,000) by the City.

WWTP Approval Process

Any new WWTP must be permitted and approved by the regulatory agencies responsible for said approval. Stanley's research has indicated that the following agencies and agency permits are involved in this process:

Mohave County Planning and Zoning Department (MCPZD)

1. 208 General Plan Amendment.
2. Building Permit.
3. Possible Zoning Amendment.

Arizona Department of Environmental Quality (ADEQ)

1. Aquifer Protection Permit (APP).
2. Arizona Pollutant Discharge Elimination System (AZPDES) permit.
3. Approval to Construct (ATC).
4. Approval of Construction (AOC).
5. Reclaimed Water Use (RW) permit.

Mohave County Environmental Health Department (MCEHD)

1. General Discussion

Descriptions of these permits follow below.

Mohave County Planning and Zoning Department

208 Plan Amendment. A 208 plan amendment is required for the property in question. Rhodes Homes has already submitted a General Plan Amendment for this property and is awaiting the next step in the process. It is expected that this will be an interactive process, with the Rhodes/Stanley team responding to questions and addressing the public's concerns during this period.

Building Permit. The wastewater treatment plant will require a Mohave County building permit. This permit application can be submitted at the same time that the ADEQ ATC permit is submitted. The primary driver for approval of the building permit is compliance to the Uniform Building Code.

Possible Zoning Amendment for the WWTP Property. It is possible that the WWTP property will require rezoning to "MP". This issue should be addressed as part of the global rezoning issue of the entire development. If it is resolved as a part of this global issue, rezoning should not impact the project critical path. Any special use permits would be included within the rezoning process, so there is no separate application required for a special use permit.

ADEQ Permits

APP. This permit is the critical path permit for the project. It's purpose is to approve the wastewater treatment plant from a water quality/treatment capacity/effluent disposal perspective. Data from the Arizona State Water Quality Control Board indicate that the average time for approval of an APP is 17-18 months from time of submission to time of approval. This process can be an ongoing process during plant design and construction, but the plant cannot be placed into operation until the APP is issued. The APP requires a certain level of design effort prior to submission of the application; typically, the design is carried to a minimum of 60% completion prior to application submittal. A pre-application meeting is highly recommended; this can introduce ADEQ to the project and serve to get a "head start" on the approval process. In addition, ADEQ uses the pre-application meeting to assist in determining the level of hydro-geologic study that they will require as a part of this process. While this pre-application meeting does not guarantee an expedited review process, Stanley believes that there is significant benefit in terms of information transfer and building goodwill with ADEQ.

It is noted that the Mohave County 208 General Plan Amendment process overlaps with the APP process. The two processes can continue on parallel tracks up to a point, but there is a point in the APP approval process that is dependent on approval of the 208 General Plan amendment. Obtaining a further understanding of this interdependency during the pre-application meeting is advised.

Based on Stanley's prior experience with the APP process, a process flow chart has been prepared. This chart is presented as Figure 7-6.

AZPDES. This permit provides the operator of the facility with the right to discharge plant effluent directly into a receiving stream or tributary. The permit is based on water quality of the treated effluent. This permit is not a requirement of a wastewater treatment plant if the plant can prove, through the APP and Reclaimed Water permit processes, that the plant will reuse or recharge 100% of the effluent at all times. It is Stanley's opinion that this will not be the case at this treatment plant; therefore, we recommend that the developer apply for an AZPDES permit. Typical time for approval of the AZPDES permit is 8-10 months, but the AZPDES permit process cannot begin until the APP process proceeds to the point that ADEQ provides a "public notice" on the project.

It is Stanley's opinion that proactive coordination with ADEQ can compress the time for permit approval, but Stanley cannot guarantee any timeframe for AZPEDS approval. Stanley has already had discussions with key personnel at ADEQ concerning this project and has received positive initial feedback. The primary initial thoughts provided by ADEQ personnel are to provide due consideration for construction of a truly "regional" facility; that is, one that not only considers flow from the developers' property but considers flow from other properties in the region. This would provide some opportunity for cost sharing in the facility and would appear to be one path that can reduce permit approval time.

Approval to Construct (ATC). This permit provides an approval to begin construction work on the facility. Typically, this permit application is submitted when the contract documents are approximately 90% complete. This process can become a critical path item if submission of the documents is not handled in a timely fashion, but Stanley's previous experiences with the northern section of ADEQ has been that they are relatively responsive to the projects they review.

Approval of Construction (AOC). This permit provides an approval of the constructed project and, along with the approved APP, are the documents that one needs to start up the plant. A key component of this application is that the project record drawings are submitted to ADEQ with the AOC.

Reclaimed Water Use Permit. This permit is required for facilities that generate and distribute reclaimed water. A Type 2 Reclaimed Water General Permit would be required. This permit takes 6-10 months to obtain. A pre-application meeting is also recommended for this permit. It

is possible that this pre-application meeting can be coordinated with the APP pre-application meeting. If the reclaimed water use permit is submitted at the same time as the APP, it does not appear that the reclaimed water permit would be a critical path item.

Mohave County Environmental Health Department

The Mohave County Health Department does not have direct review or approval procedures for the permitting of wastewater treatment plants. They have ceded all review and approval authority to ADEQ (see ADEQ permitting descriptions above). Mohave County does sign off on ADEQ's Form 113 and they are copied on the Approval to Construct and approval of Construction forms, but that is the extent of their current level of involvement in wastewater treatment plant permitting.

Comparison of Various Types of Treatment Plants

Discussion of Available Treatment Processes. There are several treatment processes that may be applicable for this development. An in-depth evaluation is beyond the Scope of this feasibility study, but an overview of available treatment processes, with a common-sense "process of elimination" approach, followed by analysis of truly feasible alternatives, best serves the needs of the development. This analysis is presented herein.

In the range of flows that are expected for the development, the following treatment processes appear to be viable:

1. Conventional activated sludge biological treatment with denitrification.
2. Extended aeration biological treatment.
3. Biological treatment followed by membrane filtration.
4. Biological treatment with a fixed film media.
5. Sequencing batch reactor.
6. Physical/chemical treatment processes.

The basic working mechanism of most wastewater treatment systems is to use microbiology to our advantage. The processes use various methods to grow microbiological colonies to remove detrimental components of the sewage. Combined with filtering and disinfection, these processes should achieve the development's goal of Class A+ effluent. Class A+ effluent is defined as follows:

1. After filtration, prior to disinfection:
   a. 24 hour average NTU measurement less than 2.
   b. No NTU measurement greater than 5 at any time.
2. After disinfection, prior to entry into reclaimed water distribution system:
   a. No fecals in 4 of last 7 daily samples.
   b. No single sample greater than 23/100 ml.
   c. 5 sample total Nitrogen, measured as a geometric mean, less than 10 mg/l.

Conventional activated sludge (CAS) biological treatment with denitrification. The conventional activated sludge process uses treatment compartments with and without air to treat

wastewater. Clarification basins allow treated wastewater to flow through the plant while holding the microbes within the plant for recycle to the aeration basins or removal to the solids handling area. This process is a common method used in Arizona. A typical process schematic is shown in Figure 7.3.

Extended aeration biological treatment. The extended aeration process is a broad category of processes that use air in various configurations to obtain treatment. These processes hold the wastewater for longer periods of time than a CAS process; hence, the generic name "extended air". Most processes in this treatment form have treatment areas with and without air, but use different means to develop these areas. Lagoons, oxidation ditches, and proprietary systems such as Biolac are just some of the extended aeration processes available. Upon inspection, lagoons and oxidation ditches do not meet the basic requirements of the development and these will not be considered further. However, certain proprietary systems such as Biolac may be applicable to the project and these will be reviewed further.

Biological treatment followed by membrane filtration. This process uses zones with and without air to treat wastewater, followed by membrane filtration. This process has gained much favor recently because membrane filtration is a true positive barrier that prevents passage of particles, bacteria and viruses. Put simply, the membranes have a certain “pore size” and anything bigger than that simply cannot pass through the membrane and cannot be in the effluent. This system can minimize land area, but is technically quite complex and maintenance intensive. A typical process schematic is shown in Figure 7-4.

Biological treatment with a fixed film media. This technology uses various media to grow the microbes on a fixed surface instead of growing the microbes in suspension. The most popular media are trickling filters and rotating biological contactors. While the biological process is similar to CAS, increased maintenance of the fixed media and sloughing of the microbes (microbial growth clumps dropping off the fixed media and clogging the system) are two problems with this technology. In addition, this process does not provide denitrification, so additional treatment units are required. Finally, Arizona's hot, dry climate is not conducive to this type of treatment system. Therefore, this system will not be considered further.

Sequencing Batch Reactors (SBR). SBRs are a biological treatment process that combines the equalization, aeration and clarification processes in one basin. Wastewater enters the tank to a certain fill level; at this point, influent stops and the wastewater is aerated. Once treatment is complete, aeration stops, the solids are allowed to settle, then both liquid and solids are evacuated from the tank, and the process begins again. This saves significant land area, but process control is more difficult to maintain because you have to adjust to meet the microbial growth rate every time the tank is refilled. A typical process schematic is shown in Figure 7-5.

SBRs have historically been used for wastewater flows less than 5.0 mgd, but recently several plants have been constructed in excess of 10 mgd. While the flows projected for the development exceed 5.0 mgd, this alternative is feasible, however the system is unproven for long term usage at large volumes.

Physical/Chemical Treatment Processes. These processes treat wastewater via a combination of chemicals and physical barriers. This technology can be employed when space is at a premium, but there are many drawbacks to this technology (very maintenance intensive plant, process control more difficult than biological processes, very high chemical cost, etc.) that make it infeasible for the development. It will not be considered further.

Common Components of a Wastewater Treatment System. Regardless of the type of biological and filtration processes used, there are elements that are common to all types of wastewater treatment systems. These elements are noted below.

Influent Pump Station. The influent pump station's purpose is to collect all influent flow from the collection system and route it to the treatment plant. The station typically consists of a wet well, mechanically operated sluice gates and submersible sewage pumps, but other pump styles may be more economical and should be evaluated. Typically, the influent pipe, wetwell structure, and effluent pipe are sized for system buildout flow conditions, with pumps installed based on shorter-term demands. For a facility this size, multiple chambers can be constructed in the wetwell to allow for operator flexibility as demands increase.

Influent Flow Meter. Influent wastewater flow can be measured in several ways; open-channel Parshall flumes, magnetic flow meters and Doppler ultrasonic meters are commonly used methods. A Parshall flume is typically used in wastewater plants because of its reliability to accurately read low and intermittent flows, ease of maintenance, and economy of installation. The flume would be located downstream from the influent pump station and upstream of the mechanical screens. The flume would be constructed within an open concrete channel and can be constructed to allow replacement of the flume for future flows.

Mechanical Screen. Mechanical screens remove inorganic and organic matter before treatment and are capable of removing objects down to 1 mm, if required, in size from the influent channel.
Different processes do require different screening requirements. Most CAS and SBR processes require less stringent screening requirements (1/8" is typical in these installations) than membranes (2 mm or 1 mm screens are used to protect the membranes), so operationally the screening process for CAS and SBR is less costly and more operator-friendly than membranes.

A compactor connected to the mechanical bar screen accumulates the screenings and can discharge into the residual bin for disposal. The units will be self cleaning, and screenings will be routed through screw conveyors to the residual bin.

In addition to the mechanical screens, a manual bar screen is typically installed for emergency purposes. This bar screen will be utilized if maintenance or repair is required to the mechanical bar screens during a peak flow period.

Grit Removal. Removal of grit (fine sand particles that provide no benefit to the biological process, for example) through mechanical means reduces the amount of grit in downstream basins, channels and piping. Grit cannot be biologically consumed in downstream basins. Once it settles, grit detrimentally affects the treatment process by reducing available basin volumes and detention times. Grit removal also helps to extend the life of, and reduce maintenance cost